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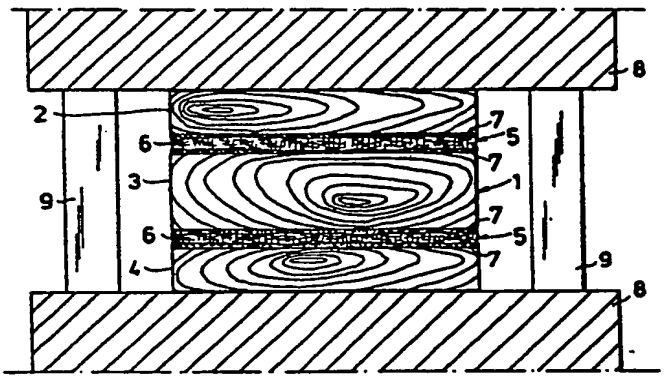

(57) Abstract

A fastener element having a sound proofing effect and forming part of a structure in which it joins components (2, 3, 4) thereof together, comprises a felt (6) having a thickness of up to about 4 mm and composed of individual, mutually twined or felted, thin flexible filaments or fibers which are resistant to tensile load, and glue layers (7) on both sides of the felt. The glue layers have a combined thickness which is smaller than the thickness of the felt and join together structural components located on mutually opposite sides of the felt in a manner such that they are well separated acoustically by, but so connected via filaments or fibres located in the glue-free intermediate layer of the fastener element (5) and extending between the glue layers as to be able to move through a distance smaller than the thickness of the intermediate layer but maintain high resistance to movement through a distance corresponding to or greater than the thickness of the intermediate layer.

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A FASTENER ELEMENT, AND A METHOD FOR PRODUCING A SOUND PROOF STRUCTURE INCORPORATING SUCH FASTENER ELEMENT

The present invention relates to a fastener element having a sound proofing effect and forming part of a structure in which it fastens components thereof together, and to a method for producing a sound proof structure incorporating at least one such fastener element.

The object of the invention is to provide a novel and improved fastener element and structure incorporating such fastener element which fulfil high requirements for effective acoustic damping and for connecting together parts of a structure in an effective manner. It will be seen that such requirements are in opposed relationship with one another.

For sound proofing purposes it is normal to isolate parts of a structure one from the other, for example with the aid of an air gap. Although the air gap is a relatively good sound proofing instrument, it is not a fastener element. When parts of a structure are joined together via elastic, porous or homogeneous material there is achieved a compromise which favours either the sound proofing function or the joining function, so that one or the other of these functions is insufficiently developed.

In order to eliminate these deficiences, at least to a substantial extent, it is proposed in accordance with the invention that a fastener element of the aforesaid kind comprises a felt having a thickness of up to about 4 mm and composed of individual, mutually twined or felted, thin flexible filaments or fibres which are resistent to tensile load, with layers of glue on both sides of the felt, said glue layers having a combined thickness which is smaller than the thickness of the felt and connecting together structural components located on opposite sides of the felt in a manner to be well separated acoustically

by, but to be connected via filaments or fibres extending between the glue layers in the gluefree intermediate layer of the fastener element as to be movable to an extent which is smaller than the thickness of the intermediate layer but maintaining a high resistence to movement through a distance equal to or exceeding the thickness of said intermediate layer.

In a structure produced in accordance with the invention, the structural components are joined together by fibres which are placed under different loads. This is true irrespective of the static and dynamic loads prevailing between the structural components. As a result, the occurance of standing waves is prevented effectively in both the structural components and the fastener element, and consequently the transmission of sound between the structural components is low. The transmission of sound between the structural components is further reduced as a result of the mutually different loading states and lengths of the fibres, which promotes the occurance of sound waves in counterphase in both the fibres and the air-filled interstices therebetween in the fastener element, such that acoustic energy is, to a large extent, converted into heat in said fibres and interstices. The acoustic damping effect of the fastener element is thus totally different to fastener elements made of a homogeneous or porous material, or glue-filled fibre material in which the occurance of standing waves is favoured by the presence of a constant modulus of elasticity.

The felt used in the fastener element according to the invention may comprise a fibre fabric in which the fibres are held together solely by mutual mechanical interlocking, although it lies within the concept of the invention to use a woven felt or fabric or one in which the fibres are mechanically, thermally or chemically bonded, provided that the individual characteristics of the fibres are retained substantially unchanged. The fibres preferably

have a thickness of one or a few hundredths of a millimeter, whereas the felt in its compressed states between the structural components preferably has a thickness of 0.5-4 mm, and the total, combined thickness of the glue layers is preferably at most equal to two thirds of the thickness of the compressed felt. Advantageously, the felt is composed of a synthetic fibre material, e.g. polyamide, polyester, or preferably polypropylene. However, the felt may alternatively be composed of natural textile fibres or metallic fibres.

The glue layers are advantageously formed with a conventional glue having good bonding properties primarily with regard to the structural components. The bonding ability against the felt fibres is noramlly of subordinate significance, since the thickness of these fibres is substantially smaller than the thickness of the glue layer and the fibres are therewith embedded in the glue layers.

As beforementioned, the invention also relates to a method for producing a sound proof structure comprising at least two structural components which present mutually facing and substantially mutually parallel surfaces which are held together by at least one fastener element located therebetween and having a thickness of up to about 4 mm. The method according to the invention is characterized in that a felt material having a thickness greater than the thickness of the fastener element and composed of individual mutually twined or felted, thin flexible filaments or fibres which are resistant to tensile load, is placed between said surfaces of two still unjoined structural components together with glue layers in the border regions between each of said surfaces and the opposite sides of the felt, the glue layers being given a combined thickness which is smaller than the thickness of said fastener element, whereupon the components with intermediate felt material and glue layers are pressed together until the distance between said surfaces is at most equal

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to the thickness of the fastener element, and are held in the thus compressed state until effective glue joints are formed between said surfaces and the opposite sides of the felt material.

Suitably, said structural components and the intermediate felt material and glue layers are pressed together between press plates in a press while using spacer means which ensure that the distance between the structural components during the pressing operation will continue to exceed the combined thickness of the glue layers.

The invention is described in the following with reference to the accompanying drawing, in which

Figure 1 is a sectional view illustrating the production of a sound attenuating structure in accordance with the invention; and

Figure 2 is a sectional view of a further embodiment of the sound attenuating structure.

In Figure 1 the reference 1 identifies generally a sound attenuating structure comprising three structural components 2, 3, 4 having facing, mutually parallel surfaces which are joined together by fastener elements 5. Each fastener element is composed of a compressible felt 6, formed from substantially individual fibres, and glue layers 7, which join the mutually opposite sides of the felt to adjacent surfaces of the components 2, 3 and 4. The fastener element 5 has a thickness of at most about 4 mm, and the combined thickness of the glue layers 7 is smaller than the thickness of the associated fastener element 5.

The reference 8 identifies two press plates, which are incorporated in a press and between which there are placed two spacers 9 which prevent the structural components 2,

3, 4 and the fastener element 5 located therebetween from being pressed together to such an extent as to reduce the distance between two mutually adjacent components 2, 3, 4 to a measurement smaller than the combined thickness of the glue layers associated therewith.

The structure illustrated in Figure 1 is a stud structure capable of being incorporated as a sound attenuating structural element in building constructions and the like.

Figure 2 illustrates an alternative structure comprising two structural components 10 and 11, and a fastener element 12 corresponding to the fastener elements 5 in Figure 1. The fastener element 12 of this embodiment also comprises a felt, 13, and glue layers, 14, in which the fibres located nearest the opposite surfaces of the felt 13 are embedded. As illustrated, the mutually facing surfaces of the components 10, 11 are angled, although nevertheless substantially parallel with one another.

The proportion of fibres in the felt 6 or 13 may, advantageously, correspond to about 5-20 percent by volume, the space between the fibres in the regions located intermediate of the glue layers 7 or 14 being filled with air.

The embodiments described above and illustrated in the drawing do not limit the scope of the invention, since the concept of the invention can be realized in any suitable manner within the scope of the following claims.

CLAIMS

1. A fastener element having a sound proofing effect and forming part of a structure in which it fastens components thereof together, characterized in that the fastener element comprises a felt having a thickness of up to about 4 mm and composed of individual, mutually twined or felted, thin flexible filaments or fibres which are resistant to tensile load, with layers of glue on both sides of the felt, said glue layers having a combined thickness which is smaller than the thickness of the felt and connecting together structural components located on opposite sides of the felt in a manner to be well separated acoustically by, but to be so connected via filaments or fibres extending between the glue layers in the glue-free intermediate layer of the fastener element as to be movable to an extent which is smaller than the thickness of the intermediate layer but maintaning a high resistance to movement through a distance equal to or exceeding the thickness of said intermediate layer.

2. A method for producing a sound attenuated structure comprising at least two structural components which present mutually facing and substantially mutually parallel surfaces which are held together by at least one fastener element located therebetween and having a thickness of up to about 4 mm, characterized in that felt material having a thickness greater than the thickness of the fastener element and composed of individual mutually twined or felted, thin flexible filaments or fibres which are resistant to tensile load, is placed between said surfaces of two still unjoined structural components together with glue layers in the border region between each of said surfaces and the opposite sides of the felt, the glue layers being given a combined thickness which is smaller than the thickness of the fastener element, whereupon the structural components with intermediate felt material and glue

layers are pressed together until the distance between said surfaces is at most equal to the thickness of the fastener element, and are held in the thus compressed state until effective joints are formed between said surfaces and the opposite sides of the felt material.

3. A method according to Claim 2, characterized in that said structural components and the intermediate felt material and glue layers are pressed together between press plates in a press while using spacer means which ensure that the distance between the structural components during the pressing operation will continue to exceed the combined thickness of the glue layers.

Fig. 1

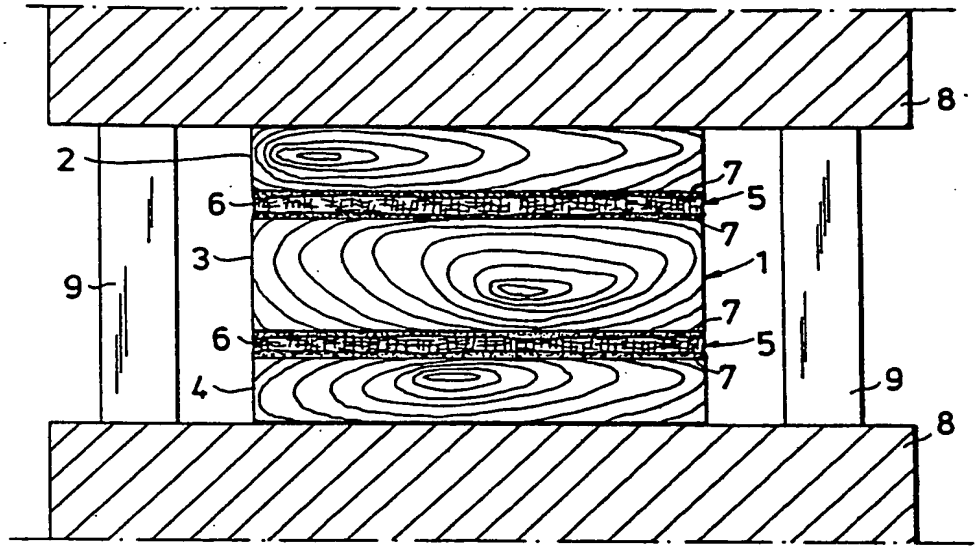
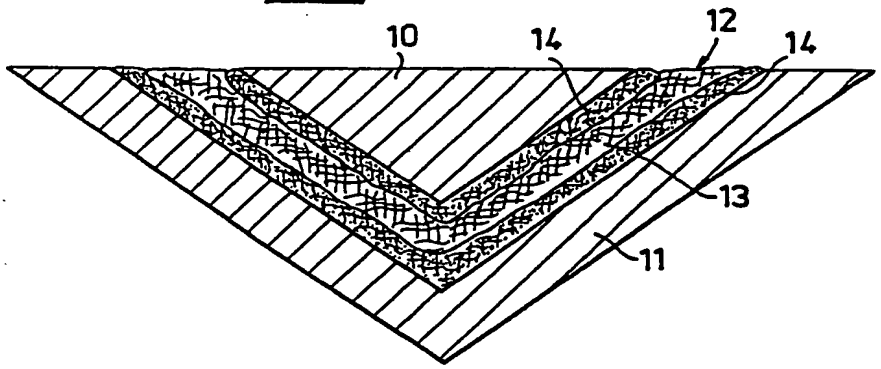


Fig. 2



INTERNATIONAL SEARCH REPORT

International Application No PCT/SE86/00206

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC [4]

E 04 B 1/82

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 4	E 04 B 1/82-/90; E 04 C 2/10-/14, /24, /26, 3/29
US Cl	52: 144, 145, 356, 402, 403, 416-419, 512; 181: 33

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	DE, C1, 714 399 (G HOFBAUER) 6 November 1941	1-3
A	CH, A5, 600 080 (M T F SAYOL) 15 June 1978	1-3
A	FR, A1, 2 343 869 (J C SABES) 7 October 1977	1-3
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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
1985-05-29	1986 -06- 09
International Searching Authority	**Signature of Authorized Officer**
Swedish Patent Office	Vilho Juvonen

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